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ABSTRACT

Recent theories in cognitive psychology have emphasized the role of capacity requirements in encoding tasks. To examine the notion that age-related differences in the recall performance reflect differences in cognitive capacity, 80 adults (40 undergraduates, and 40 senior citizens) recalled newspaper advertisements under free recall and cued recall conditions. An analysis of the patterns of recall revealed quantitative but not qualitative differences among the subjects. Compared to older adults, young adults recalled more items and improved their performance across trials. Young adults also recalled more categories and more items per category than did older adults. However, in analyzing the pattern of recall no differences were found between the two age groups. Under the cued recall condition, younger adults recalled more items than did older adults. These findings suggest differences in cognitive capacity among these subjects. (Author/BL)

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CAPACITY DIFFERENCES REFLECTED IN THE RECALL PERFORMANCE OF ADULTS

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ABSTRACT

The notion was examined that age-related performance differences on recall tasks reflect differences in cognitive capacity. A distinction (automatic/effortful) previously applied to encoding processes was extended here to retrieval processes. It was assumed that free recall tasks are effortful and can be used to uncover capacity differences among subjects. Free and cued recall for advertisements was examined in 80 young and elderly subjects. Patterns of recall revealed quantitative not qualitative differences. This suggests differences in cognitive capacity among these subjects. Implications of this interpretation will be discussed.

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In this study, the recall of both young and elderly subjects was tested using newspaper advertisements as stimuli. Recall performance is generally found to be poorer in elderly compared to young adult subjects. One explanation for such age differences is that recall is a task which is very demanding of cognitive capacity and that older subjects are likely to have less capacity compared to younger adults.

A number of recent theorists in the field of cognitive psychology have elaborated notions about capacity requirements of encoding tasks. For example, distinctions have been made between memory processes which are demanding of cognitive capacity (effortful, deliberate, controlled processes) and those which are relatively undemanding of cognitive capacity (automatic processes) (Hasher & Zacks, 1979; Posner & Snyder, 1975; Shiffrin & Schneider, 1977). While the two types of processing are different in a number of ways, they are thought to define anchor points along a continuum (Hasher & Zacks, 1979, Shiffrin & Schneider, 1977). So, tasks requiring automatic processing and, thus, little cognitive capacity occupy one end of the continuum and tasks requiring effortful processing and substantial cognitive capacity should occupy the other end.

It will be argued here that the automatic/effortful distinction is also useful when considering retrieval tasks. Some, such as recall, seem clearly more demanding than others (e.g., recognition). If, effortful memory pro-

cesses (both at encoding and at retrieval) are deliberate strategies, require substantial cognitive capacity, improve with both practice and intention, and are engaged consciously, age related effects should be expected on tasks requiring them. It is not clear though whether performance differences result from less capacity in the older subjects or a less efficient use of similar amounts of capacity compared to the younger subjects.

The present research was intended to examine these two possibilities (i.e., less capacity vs inefficient use of capacity). Patterns of performance on recall tasks were examined to differentiate between them. For example, if older subjects recall less information than did the younger subjects but do so using recall strategies which are like those of the younger group, quantitative differences can be assumed to exist. These could reflect capacity differences. If, on the other hand, older subject recall less and use very different recall strategies, qualitative differences exist. These are more likely to indicate inefficient use of cognitive capacity. In this latter case, training procedures could be developed which would enable the older subjects to be more efficient information processors. Capacity differences are more difficult to ameliorate.

Method

Subjects. A total of 80 subjects participated in this study. Forty were undergraduates at Temple University and forty were community dwelling senior citizens. The younger subjects received course credit for their participation and the older subjects were paid a small amount. The ages of the younger subjects ranged from 17 to 34 and those of the older subjects ranged from 64 to 83.

Materials. Materials consisted of two sets of test booklets which resembled a newspaper. An advertisement occupied one of the quadrants of each double page spread. So, each set of materials included 16 different advertisements. Of these, four were drawn from each of four categories. There were no overlapping categories between the two sets of test materials. The order of the advertisements was randomly selected with the restriction that one ad from each category appear within each quarter of the booklet.

The eight categories used here were determined on the basis of ratings by 33 college and 22 older subjects. Ratings reflected the interest each subject had in reading an ad of that type and on the degree to which each ad clearly represented its particular category. None of the subjects who provided these ratings participated in the present study.

Procedure. Subjects were tested in small groups (2 - 5 individuals) which were homogeneous for age. Each subject was required to attend two sessions separated by one week in order to receive credit or pay. During the first session, each subject filled out a background questionnaire and was given general memory instructions about the forthcoming task. Study time was controlled by the experimenter and proceeded at a 15 second rate. Following the study trial, subjects participated in several types of memory task which included free recall, cued recall, and recall of both spatial and temporal information. All of the tasks were unpaced and they were presented in the same order for each subject. Only the outcome of the free and cued recall tasks will be presented here. Results of the spatial task have been discussed elsewhere (Attig, 1983). Subjects were also exposed to one of several simple training procedures at the end of the first session. These were unsuccessful, but this was only determined after the initial analyses. Thus, the training

variable is included in them but not in later analyses.

Results

Free Recall. A three way analysis (age by type training by trials) was performed on the total number of items recalled (of 16). Results revealed an age effect, $F(1,72) = 17.22$, $p < .01$, with younger subjects recalling more items than the older subjects ($\bar{X} = 10.91, 8.65$; young, old respectively). There was also an age by trials interaction, $F(1,72) = 4.05$, $p < .05$. Post hoc analysis indicated that this was due to the fact that younger subjects improved slightly across trials ($\bar{X} = 10.25, 11.58$; trial 1, trial 2 respectively) while the older subjects did not ($\bar{X} = 8.68, 8.62$; trials 1 and 2).

Further analyses were done to determine whether the age differences found above reflect qualitatively different types of processing for the two age groups. First, the number of categories recalled (of 4) was investigated in a two-way analysis of variance (age by trials). Results of this analysis indicate that younger subjects did indeed recall more categories ($\bar{X} = 3.88$) than the older subjects ($\bar{X} = 3.62$), $F(1,78) = 8.30$, $p < .01$. Next, the number of items recalled (of 4) in each of the four categories was investigated in a three-way analysis of variance (age by trials by category size). Age differences were found here as well with younger subjects recalling on average more items ($\bar{X} = 2.73$) per category than did the older subjects ($\bar{X} = 2.16$), $F(1,78) = 17.88$, $p < .01$. An interaction between age and trials was also present, $F(1,78) = 4.17$, $p < .05$. This occurred because while the performance of all subjects was stable across trials ($\bar{X} = 2.57, 2.89$; trials 1, 2 young Ss) ($\bar{X} = 2.17, 2.14$; Trials 1, 2 elderly Ss), the younger subjects recalled more items per category on trial 2 than the older Ss had recalled. Effects were also present which indicated that subjects recalled different numbers of items

across the different categories, $F(3,234) = 8.68$, $p < .01$, and that there were differences in these patterns by age, $F(3,234) = 10.51$, $p < .01$. This suggests that young and older Ss recalled different categories, but is hard to interpret because Ss of both age groups received different orders of categories across the two trials. Of more interest is the fact that younger Ss excelled on all measures so far discussed. That is, they recalled both more categories and more items per category compared to the older group.

The final analysis of this set was done to investigate whether, in fact these age differences in recall were due to sytlistic differences in memory strategies across the two age groups. That is, were both groups systematically recalling several items of one category before proceeding or was the lower recall of the older group due to their more haphazard recall strategy? In this analysis, a measure of clustering (ARC) suggested by Puff (1982) was used:

$$ARC = R - E(R))/(T - E(R))$$

where;

R = the number of times a category member follows a member of the same category

E(R) = the sum of each category recall squared divided by total recall and then quantity minus 1.

T = total recall

With this measure, the dependence of the number of repetitions on total recall is corrected to reflect the number of categories represented in recall. Thus, the final cluster score is independent of actual recall. The ARC scores were analyzed in a two-way analysis of variance (age by trials), however, no

significant effects were found. Thus, while the recall of older subjects is lower overall, the pattern of their recall is similar to that of the younger group.

Cued Recall. After the free recall task on each trial, Ss were given the names of each of the four categories and asked to try to recall the ads again. Results of this task were analyzed using a three-way ANOVA (age by training by trials) and a significant effect was found due to age, $F(1,72 = 30.12$, $p < .01$. Younger subjects were able to recall more items ($\bar{X} = 12.20$ of 16) than the older subjects ($\bar{X} = 9.46$ of 16). This also represents a higher level of recall than was found on the free recall trial, $F(1,72) = 56.42$, $p < .01$. There was, however, no effect due to trials nor any interaction.

Summary. Overall, results of the analyses of the tasks requiring effortful processing show clear age differences which suggest that older Ss are using strategies like those of the younger Ss but with less success. Thus, older Ss are not adopting inefficient procedures but are apparently limited in their ability to use efficient ones. While subject variables may play a role in performance here, the most parsimonious explanation for this pattern of results is that there are differences in the cognitive capacity which subjects of these two groups have available.

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